Method of and device for ascertaining due presence of a disc-shaped data carrier in a nominal position

FIELD OF THE INVENTION

The invention relates to a method of ascertaining due presence of a disc-shaped data carrier in a nominal position.

The invention furthermore relates to a device for ascertaining due presence of a disc-shaped data carrier in a nominal position.

The invention furthermore relates to a recording and/or playback unit for a disc-shaped data carrier comprising a device of the type mentioned in the second paragraph.

The invention furthermore relates to a use of a method of the type mentioned in the first paragraph and/or of a device of the type mentioned in the second paragraph.

BACKGROUND OF THE INVENTION

In connection with the use of recording and/or playback units for disc-shaped data carriers, such as a CD or DVD for example, wherein the disc-shaped data carrier is scanned by a laser beam, for safety reasons it is necessary that a user can under no circumstances look directly into the laser beam which is used to scan the disc-shaped data carrier. It must therefore be ensured that operation of the laser is reliably prevented particularly in the case where no disc-shaped data carrier is located in the playback unit or in a holder for the disc-shaped data carrier.

In connection with recording and/or playback units or devices for such disc-shaped data carriers, embodiments are known for example in which the disc-shaped data carrier is received on a holder which can be moved out of the unit and is designed in a manner similar to a drawer, and once the data carrier has been placed on the holder the latter is drawn back into the unit and operation of the unit can take place only if due presence of the holder with the data carrier in a nominal position within the unit is ascertained. In such units, there is virtually no possibility of direct visual contact with the laser beam by a user, so that in such playback units appropriate safety measures are usually limited to ascertaining the position of the holder.

In connection with receiving openings which are arranged for example on the top of a unit, which can be opened and closed for example by a pivotable cover, wherein the

disc-shaped data carrier is placed in the receiving opening once the cover has been opened or pivoted, it must be ensured that the laser for forming the laser beam for scanning the data carrier, which laser is usually provided directly below the inserted disc-shaped data carrier, is operated only once the data carrier has been duly placed in the unit and the cover has been closed.

In this connection, patent document US 4 499 571 A for example discloses a unit design comprising a detector which can be used to determine and/or check the presence of a disc-shaped data carrier, for example a CD, at a predefined position, wherein a detector for ascertaining or monitoring the rotational movement of the disc-shaped data carrier is additionally provided. In this known unit design, once signals from the two detectors have been evaluated, operation of the laser beam source can take place only if due presence of the disc-shaped data carrier in its nominal position has been ascertained. In this known unit design, however, it has proven to be disadvantageous that particularly the detector for checking the presence or absence of the disc-shaped data carrier in the holder or in the receiving opening can be bypassed for example by a mirror or by placing a similar element in the receiving opening, so that there is the risk that the laser beam source will be operated even though the disc-shaped data carrier is not duly arranged in the unit or is not present.

Such a possibility of bypassing the detector in the known type of unit is all the more significant if, for example, for design reasons there is no cover or lid for the receiving opening for the disc-shaped data carrier, so that in the event of improper use direct contact with the laser beam is possible. The possibility of such relatively simple bypassing of the detector or of the safety device for checking due placement of a disc-shaped data carrier in the known unit makes such a known safety system unsuitable in connection with various recording and/or playback units, and specifically in those which have to meet higher safety requirements, for example in those units which are designed for use by children or handicapped people.

OBJECT AND SUMMARY OF THE INVENTION

It is an object of the invention to provide a method of the type mentioned in the first paragraph, a device of the type mentioned in the second paragraph and a recording and/or playback unit of the type mentioned in the third paragraph and a use of the type mentioned in the fourth paragraph, in which the abovementioned disadvantages are avoided.

In order to achieve the above object, a method according to the invention can be characterized as follows:

A method of ascertaining due presence of a disc-shaped data carrier in a nominal position in a recording and/or playback unit, wherein use is made of a data carrier having a transmission path which starts at a first boundary surface of the data carrier and passes through the data carrier and ends at a second boundary surface of the data carrier, which transmission path is transparent to a test beam, and wherein an optical test beam is provided, and wherein the test beam is passed through the data carrier using the transmission path when the data carrier is present in the nominal position, and wherein the test beam passed through the data carrier using the transmission path is detected.

In order to achieve the above object, a device according to the invention can be characterized as follows:

A device for ascertaining due presence of a disc-shaped data carrier in a nominal position in a recording and/or playback unit, which data carrier has a transmission path which starts at a first boundary surface of the data carrier and passes through the data carrier and ends at a second boundary surface of the data carrier, which transmission path is transparent to a test beam, comprising: provision means for providing a test beam, which provision means are designed and arranged such that the at least one test beam can be fed to the transmission path at the first boundary surface of the data carrier when the data carrier is present in its nominal position, and detection means for detecting the at least one test beam emerging from the transmission path at the second boundary surface when the data carrier is present in its nominal position.

In order to achieve the above object, in a recording and/or playback unit according to the invention, a device according to the invention is provided.

In order to achieve the above object, according to the invention a method according to the invention and/or a device according to the invention is provided in a children's toy.

By virtue of the measures according to the invention, bypassing of a detector or of a safety device formed by the detector, as is possible in known embodiments, is virtually no longer possible since according to the invention activation of the laser beam or of the laser beam source takes place only once it has been detected that the optical test beam provided, which is not harmful in the event of direct contact with a user's eyes, has duly passed through the transmission path of the disc-shaped data carrier, said transmission path having a specific course. Thus, essentially the transparent property of the transmission path of the disc-shaped data carrier is used in a manner similar to a light guide, so that detection of the test beam by the detection means is possibly only once the disc-shaped data carried has

been correctly placed in a nominal position in a unit or in a holder of the unit, since only after the disc-shaped data carrier has been duly and correctly positioned is transmission of the test beam through at least a part-area of the disc-shaped data carrier possible using the transmission path from a light source to the detection means, said transmission path being formed by part of the data carrier. Using simple means, and in particular without posing a risk to a user, it is thus ensured that a laser beam used to scan the data carrier or the data stored thereon is activated only once the disc-shaped data carrier has been duly positioned in the unit.

Furthermore, in the context of the method according to the invention and in the device according to the invention, it is not possible to bypass the safety device formed by the method according to the invention and the device according to the invention since a light guide, for which the disc-shaped data carrier is used when duly positioned in the playback unit, cannot readily be made available in order to duly conduct the test beam transmitted by the light source to the detection means. On account of the fact that the safety system provided by the method according to the invention and the device according to the invention can thus virtually not be bypassed by a normal user, the method according to the invention and the device according to the invention are also suitable in particular for a children's toy, in which higher safety standards usually have to be met.

According to the measures of claims 2 and 8, the advantage is obtained that, within the context of ascertaining a correct position or presence of a disc-shaped data carrier, the test beam must have passed through the disc-shaped data carrier at least once in an at least approximately radial direction before the test beam reaches at least one receiver provided next to the circumference of the disc-shaped data carrier, so that a signal required to subsequently activate the laser beam cannot be received by at least one receiver even in the event of slight deviations from a due position or presence of the disc-shaped data carrier. By providing a light-emitting diode (LED) as the source of the test beam, it is possible to use only simple means, wherein an LED can also be produced in a cost-effective manner.

According to the measures of claims 3 and 10, the advantage is obtained that, even with the usually restricted space conditions in the region of a holder of a unit for the disc-shaped data carrier, the test beam can be reliably provided in the region of an edge of the disc-shaped data carrier, so that the test beam is duly introduced into the disc-shaped data carrier and can pass through at least a part-area in the direction of the disc plane of the disc-shaped data carrier, wherein the latter is used essentially as a light guide. By suitably deflecting the beam device of the test beam, due entering in particular of a light beam in the

region of the edge of the disc-shaped data carrier can thus be ensured sometimes independently of the positioning of the light source. Instead of a deflection mirror for example for deflecting a light beam, suitable light guides may also be used for example to bring the test beam to a desired position in the region of the edge of the disc-shaped data carrier.

According to the measures of claims 4 and 11, the additional advantage is obtained that for example effects of environmental influences, such as scattered light for example, can largely be excluded. The safety and reliability of the evaluation within the context of the method according to the invention and when using the device according to the invention are thus further increased since activation of the laser beam or laser beam source takes place only once a signal has been detected at least at one receiver, wherein the pulse shape and/or pulse train of the detected signal is compared with the pulse shape and/or pulse train of the signal sequence output by the light source of the test beam.

According to the measures of claim 5, the reliability during evaluation of the detected signal can be further increased so that environmental influences are further minimized.

According to the measures of claims 6 and 9, the accuracy of the evaluation and thus the safety are further increased since a signal has to be received at a plurality of points next to the circumference of a data carrier before the laser beam source is activated. In general, it is to be assumed that, by using a light source for a non-bundled light beam or test beam, this test beam – possibly aided by appropriate reflections within the disc-shaped data carrier – is distributed over relatively large part-areas of the extent of the disc-shaped data carrier, so that suitable signals which can be evaluated are actually received at a plurality of points next to the circumference of the disc-shaped data carrier.

By distributing a visible light beam through the extent of the disc-shaped data carrier, besides the safety which can be achieved, optically perceivable effects can also be achieved, wherein this is advantageous in particular in the case of a playback unit having a receiving chamber without a cover.

The method and the device according to the invention may advantageously be used so that the laser beam source provided for scanning the data carrier passes from a rest position into an active position below the disc-shaped data carrier only once a due and correct presence or position of a disc-shaped data carrier in a receiving chamber or holder of a recording and/or playback unit has been ascertained. In the rest position, the laser or laser

beam source assumes a position outside the outer dimensions of the disc-shaped data carrier and in particular below an additional cover or protective device.

As already mentioned above a number of times, since they meet increased safety requirements, the method according to the invention and the device according to the invention are particularly suitable for a children's toy in which manipulation or bypassing of safety devices is made more difficult or made virtually impossible, so that according to the invention the method according to the invention and the device according to the invention are preferably used or integrated in a children's toy.

The abovementioned aspects and further aspects of the invention emerge from the examples of embodiments described below and are explained with reference to these examples of embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be further described with reference to examples of embodiments shown in the drawings to which, however, the invention is not restricted.

Fig. 1 schematically shows a recording and/or playback unit according to the invention for a disc-shaped data carrier, in particular a CD or DVD, which has a device according to the invention for ascertaining due placement of the disc-shaped data carrier for carrying out a method according to the invention.

Fig. 2 shows, in a manner analogous to Fig. 1, a side view of the recording and/or playback unit shown in Fig. 1.

Fig. 3 shows, schematically and partially in plan view, the recording and/or playback unit according to the invention which is shown in Fig. 1, wherein a disc-shaped data carrier is inserted and the transmission path for the test beam passing through the disc-shaped data carrier is indicated.

Fig. 4 shows, on an enlarged scale and in a manner similar to Fig. 2, a side view of a modified embodiment, wherein a light beam is deflected for introduction into the disc-shaped data carrier.

Fig. 5 schematically shows a circuit of a device according to the invention for ascertaining due presence of a disc-shaped data carrier.

Fig. 6 schematically shows a circuit as shown in Fig. 5, the design of which has been modified compared to said circuit.

Fig. 7 shows a further modified design of a circuit.

DESCRIPTION OF EMBODIMENTS

Fig. 1 shows a recording and/or playback unit 1 which has a housing 2. An optical scanning unit 3 includes inter alia a laser beam source 4, wherein in the embodiment shown in Fig. 1 it can be seen that the optical scanning unit 3 and the laser light source 4 can move back and forth between a rest position shown in Fig. 1, in which the optical scanning unit 3 is located below a cover 5 which in particular is not transparent, along guides or guide rails 6 for scanning a disc-shaped data carrier 8 (shown schematically in Fig. 1), along the guides 6 in the direction of the double arrow 7, in order to be able to be brought into an active position or scanning position.

The mode of operation of the optical scanning unit 3 and the drive movements required to scan a disc-shaped data carrier 8 are generally known and are not described in any greater detail here.

It can furthermore be seen from Fig. 1 that a drive element 9 (likewise known per se) for driving a disc-shaped data carrier 8 is provided, wherein the drive element 9 acts in the region of an essentially central passage opening 10 of the disc-shaped data carrier 8 and cooperates with the data carrier 8.

Also provided in Fig. 1 is a light source 11 which is formed for example by a light-emitting diode (LED), which light source – as explained in more detail below – provides a test beam which passes at least partially through the disc-shaped data carrier 8 and is received in receivers 13 arranged on the circumference of a receiving opening or a holder 12 for the disc-shaped data carrier 8. Evaluation of the signal obtained in the receivers 13 on the basis of the received test beam for subsequent activation of the laser beam source 4 will be described below in particular with reference to the circuits in Figs. 5 to 7.

A drive stage 14 for moving the optical scanning unit 3 along the guides 6 is shown in Fig. 1. Also shown is a further drive stage 15 for driving the drive element 9.

Enlarged access openings 16 are also provided along the receiving opening 12 for the disc-shaped data carrier 8, via which access openings a user can manually access the data carrier 8.

In the diagram shown in Fig. 2, it can be seen that the light source 11 for the test beam is arranged essentially below the plane of the disc-shaped data carrier 8 and the test beam is introduced into the disc-shaped data carrier 8 in the region of the central passage opening 10, as shown in more detail in the schematic diagrams of Figs. 3 and 4. In the diagram shown in Fig. 2, additional clamping devices 17 for due holding of the disc-shaped

data carrier 8, in particular the CD or DVD, in its nominal position are provided in the region of the drive element 9.

In the diagram of Fig. 3, a plurality of possible transmission paths or beam paths are shown within the extent of the disc-shaped data carrier 8. It can be seen here that the test beam generated by the light source 11 is distributed over the extent of the disc-shaped data carrier 8 starting from the central region of the disc-shaped data carrier 8, on the one hand on account of the fact that it is a source for a non-bundled beam and on the other hand possibly on account of multiple reflections in particular at the outer circumference 18 of the disc-shaped data carrier 8, so that despite only one light source 11 being provided, the test beam is received at a plurality of receivers 13 distributed over the circumference. As a consequence of the receipt of the test beam, detection signals are generated by the receivers 13, which detection signals are then evaluated, as explained in more detail with reference to Figs. 5 to 7.

It can furthermore be seen from Fig. 3 that the test beam must have passed through the disc-shaped data carrier 8 at least once, essentially along a direction which corresponds at least approximately to a radial direction, before a signal can be received in at least one receiver 13 on the outer circumference of the receiving opening 12. Since the disc-shaped data carrier 8 is used essentially as a light guide for the test beam, detection signals caused by the test beam can be generated in the receivers 13 only if the disc-shaped data carrier 8 is actually duly positioned in its receiving opening 12, that is to say in its nominal position. The disc-shaped data carrier 8 or the plurality of transmission paths formed thereby is/are thus used directly to detect a correct position of the data carrier 8.

It can be seen from Fig. 4 that the light source 11 for the test beam, which light source is once again formed by an LED, is arranged below the disc-shaped data carrier 8, wherein multiple deflection of the light beam generated by the LED 11 in terms of its propagation direction or beam direction takes places in order to ensure due introduction of the test beam into the disc-shaped data carrier 8, wherein deflection elements 19 and 20 are shown in Fig. 4. In particular, the deflection element 20 may in this case be integrated or accommodated in the drive element 9 for the rotary drive of the disc-shaped data carrier 8.

Instead of such deflection elements 19 and 20, a corresponding light guide may also be provided which ensures that the test beam of the light source 11 is introduced in the region of an edge of the disc-shaped data carrier 8, so that, in order to ascertain the due presence or position of the disc-shaped data carrier 8 in the unit 1, the test beam passes through at least one part-area of the extent of the disc-shaped data carrier 8.

Fig. 4 furthermore shows that the electromagnetic radiation in the disc-shaped data carrier 8 essentially propagates by total reflection at the upper and lower boundary surfaces of the disc-shaped data carrier 8, so that, when the electromagnetic radiation is introduced into the disc-shaped data carrier 8, it must be ensured that at least most of the test beam introduced enters the material of the disc-shaped data carrier 8 at a suitably flat angle, in order to be able to pass through the upper and lower boundary surfaces by using the total reflection at the latter.

Since a disc-shaped data carrier 8 is usually made of a transparent material, besides the safety which can be achieved when passing through the disc-shaped data carrier 8 in terms of ascertaining a correct position of the data carrier 8 in the unit 1, additionally a design effect can be achieved when using visible light in particular when distributed over the disc-shaped data carrier 8, as shown in Fig. 3, so that for example the edges of the data carrier 8 can shimmer in the color of the test beam.

Fig. 5 schematically shows a circuit of the essential components for carrying out the method of ascertaining due presence of a disc-shaped data carrier 8 in a playback unit which is not shown in any greater detail in Fig. 5. This circuit contains a driver 21 for generating a test signal, which test signal is fed to the light source 11 for providing the test beam, which test beam is fed to the data carrier 8 or to the transmission path 22 contained in the data carrier 8. Once the test beam has at least partially passed through the data carrier 8, as shown schematically along the transmission path, the test beam reaches a receiver 13 which detects the test beam and generates a detection signal, wherein signal processing is carried out by means of a downstream filter 23 and a comparator 24. An output signal of the comparator 24, which forms the detection signal, is made available to an evaluation unit 25 which contains a control unit, which evaluation unit 25 outputs via an output 26 a control signal for activating the optical scanning unit 3 (not shown in Fig. 5) if due positioning of the disc-shaped data carrier 8 in its nominal position has been ascertained. Alternatively, a further control signal can be output at an output 27 of the evaluation unit 25, which further control signal ensures that the optical scanning unit 3 is moved back to the rest or standby position (shown for example in Figs. 1 and 3) if no signal which indicates due presence of the disc-shaped data carrier 8 can be detected at least at one receiver 13.

While it is possible to manage with a simple evaluation by ascertaining the occurrence of a detection signal at least at one receiver 13, in the diagram of Fig. 5 it is additionally shown that a pulsed signal is fed to the driver 21 via a line 28 to the evaluation unit 25, so that the light source 11 outputs a correspondingly pulsed test beam. It should be

mentioned at this point that in general a modulated signal may be used which may for example have an amplitude modulation or a pulse width modulation or any other suitable form of modulation.

Subsequently, in the event of a correct presence or position of the disc-shaped data carrier 8, a pulsed signal will be ascertained in the receiver 13, so that in order to increase the safety and to reduce environmental influences, for example of scattered light, in the evaluation unit 25, the pulse shape and/or pulse width of the detection signal detected or received in at least one receiver 13 is compared with the pulse shape and/or pulse width fed to the driver 21 via the line 28, and the optical scanning unit 3 is activated only once the pulse shape or pulse width or amplitude values of the signals to be compared, that is to say of the test signal and of the detection signal, have been correspondingly evaluated.

From the circuit shown in Fig. 6, it can be seen that the plurality of sensors or receivers 13 arranged around the disc-shaped data carrier 8 are coupled to one another in such a way that their signals are collected in a common collecting or summing node 29, wherein the collective or summed signal is once again made available to the evaluation unit 25. In the variant embodiment shown in Fig. 6, the circuit may be provided such that for example activation of the optical scanning unit 3 takes place only if detection signals are present in all the receivers 13.

In the modified variant embodiment shown in Fig. 7, detection signals from the plurality of receivers 13 are fed essentially directly to the evaluation unit 25, so that for example, in the evaluation unit 25, if detection signals from a predefined number of receivers 13 are present, a correct position or presence of the disc-shaped data carrier 8 is ascertained and subsequently the optical scanning unit 3 is activated.

It may be mentioned that, instead of the essentially central arrangement of the light source 11 for the test beam and the arrangement of the receivers 13 essentially along the circumference of the disc-shaped data carrier 8 as shown in Figs. 1 to 4, the relative positioning between the light source 11 and the receivers 13 may be reversed.

It may furthermore be mentioned that for example the light source 11 may also be provided in the region of the circumference of the disc-shaped data carrier 8 and the electromagnetic radiation may be introduced into the disc-shaped data carrier 8 in the region of the circumferential edge of the disc-shaped data carrier 8, wherein for example a plurality of receivers 13 is likewise provided in a manner distributed over the circumference of the disc-shaped data carrier 8. It must once again be ensured that at least a part-area of the extent of the disc-shaped data carrier 8 is passed through by the test beam before the test beam can

be received by at least one receiver 13. Such a beam path or such a transmission path is schematically shown in Fig. 5 for example by the reference 22.

It may furthermore be mentioned that, instead of a design of the unit 1 without a cover or lid for the receiving opening 12 for placing and holding the disc-shaped data carrier 8, as shown in Figs. 1 to 4, a device for ascertaining due placement of the disc-shaped data carrier 8 for carrying out the method may also be integrated in a unit 1 which is provided with an additional cover for the disc-shaped data carrier 8.

As already mentioned a number of times, the device according to the invention for carrying out the method of ascertaining due presence of the disc-shaped data carrier 8, in particular taking account of the fact that an undesirable manipulation or bypassing of the safety system formed thereby is not possible or is hardly possible, is particularly suitable for use or integration in a children's toy or in a design of the unit 1 as a children's toy.

It should furthermore be mentioned that it is also possible to provide a number of light sources, for example light-emitting diodes, for generating a number of test beams. Instead of light-emitting diodes, however, it is also possible to provide other electric or electronic light sources. The light sources are preferably designed to generate visible light. However, it is also possible to use light sources for generating infrared light or ultraviolet light.

It may furthermore be mentioned that a data carrier may also have a number of transmission paths. However, it is important in all cases that the respective transmission path starts at a first boundary surface of the data carrier and ends at a second boundary surface of the data carrier, which second boundary surface is different from the first boundary surface. It should furthermore be mentioned that a data carrier may also be a data carrier which can be scanned magnetically.